THE NEW RENAISSANCE: THE COMPUTER REVOLUTION AND THE ARTS

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This is a meditation on the computer and its role in that long- heralded, mythical transformation of culture and consciousness known as the Communications Revolution, which, for at least a generation, has seemed perpetually about to happen. My premise will be that we are indeed on the threshold of a genuine communications revolution, which will occur only after the computer revolution that is making it possible. But a communications revolution isn't really about technology at all; it's about the possible relations among people; it implies an inversion of existing social relations, whereby today's heteronomous mass culture would disperse into autonomous self-constituting "reality-communities"—social groups of politically significant magnitude, defined not by geography but by consciousness, ideology, and desire. It seems to me that widespread use of personal tools for simulation (computers) and conversation (two-way video) make the rise of such communities all but inevitable; and as their constituents we could both produce models of possible realities and also control the cultural context in which those models were published and perceived. I believe this is not only possible but essential for human dignity and survival: the continuous simulation of alternative realities within autonomous reality-communities constitutes a New Renaissance in which the artist-designer might address the profound social and political challenges of our time.

The Microelectronics Revolution

Everyone knows that the future of audiovisual communication (the "moving-image arts") will be electronic. But the profound implications of that fact are not generally appreciated, primarily because the full force of the electronics revolution has yet to be unleashed. For electronics, the last quarter- century has been equivalent to pulling back the string on a bow— the storing of enormous technological potential. By all accounts, the next twenty-five years will represent the flight of the arrow—the universal application of that potential, propelling us into the Electronic Age and precipitating an historically unprecedented revolution in communications.

In its prodigious twenty-five year history, microelectronics has evolved through three distinct generations characterized by levels of integration of microcircuitry. Starting in 1965, Small Scale Integration (SSI) yielded about ten transistors per chip; the move to Medium Scale Integration (MSI) in 1970 increased chip density to about 200 transistors and made feasible the scientific pocket calculator; Large Scale Integration (LSI) with ten thousand transistors per chip, began in 1975, making possible the mass production of the general-purpose personal computer.

This historical progression, advancing exponentially rather than geometrically, has been characterized as a revolution. I suggest, however, that the Electronics Revolution is only now beginning as we enter the era of Very Large Scale Integration (VLSI). It is generally agreed that VLSI technology will increase computing power by a factor of a thousand in the coming decade, eventually packing ten million transistors on a chip. To gain some perspective on the significance of this statement, consider the exponential growth of algae in a pond: if the microorganisms will consume the pond in one month, when will it be half consumed? The answer is the next to the last day. That is the magnitude of the transformation that looms ahead as we stand on the brink of the VLSI revolution: it is the eve of the next to the last day.

Virtuality: The Computer as Universal Machine

It is crucial to understand the computer as a universal machine that has no intrinsic nature or identity until it is programmed to become something. And, in principle, it can become *anything* that can be precisely defined. Depending on its software the computer can contain and become words, writing, print; can contain and become sounds, speech, singing, music; can contain and become pictures, drawings, design, animation, movies; can contain and become heartbeats,

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automobiles, and spaceships. In computer jargon this is known as "virtuality"—the capacity of the machine to "become" many different things while actually being none of them. It is a virtual instrument—a virtual typewriter, a virtual camera, a virtual piano, a virtual person, a virtual universe.

The New Renaissance

VLSI technology makes theoretically possible the mass production of personal computers more powerful than any machine on Earth today —quite capable indeed of containing and becoming all the arts and sciences in which men and women are engaged. Once we have crossed the VLSI threshold, every computer can in principle be extremely intelligent, behaving like a cognitive entity that draws inferences and engages the user in a natural- language creative conversation. Under such circumstances the computer user is best characterized as a "designer" in the broadest sense, whose work with the computer, no matter what it is, should be understood as "simulation."

If the computer can in fact contain and become all media and instruct the user in the operation of itself as a virtual instrument, then the computer user must be understood as a Renaissance Person. Leonardo da Vinci was certainly a genius; but he was also representative of the early Renaissance concept of the artist—a concept that has been lost in the Modern Age. The early Renaissance artist bridged the gap between the abstract world of the intellect and the tangible world of the craftsman, integrating a variety of interests and activities. Alberti was a lawyer, mathematician, author, scientist, inventor, painter, sculptor, and architect. Michelangelo was a sculptor, painter, architect, and poet, Piero della Francesca was a painter and mathematician, and Raphael was a painter and architect. Today they would almost certainly be computer users and programmers.

Amateurs and Professionals

By becoming all media the VLSI computer promises, among other things, to erase the distinction between professionals and amateurs insofar as that's determined by the tools to which we have access as autonomous individuals. No motivation is so pure, no achievement more dignified than that of the amateur who does it for love. Yet in our professionalized society this most noble aspiration has been reduced to a sneering joke—the amateur as some kind of bozo—as though doing it for love were synonymous with ineptitude, an absence of quality and value. As a matter of fact, it is precisely the industrialization of cinematic practice by "professionals" that is responsible for the bankruptcy of imagination in the most protean artform of our time. Some of the most important and interesting works of moving-image art ever produced were made by skilled "amateurs" working in their living rooms with tools they designed and built. They aren't "hobbyists," they are artists; but please excuse them, they can't afford "professional" tools just yet.

Autonomy Versus Heteronomy

The practice of the moving-image arts can be divided into five technical categories: (1) production or acquisition of image and sound; (2) recording this information in some storage medium; (3) processing or post-production; (4) distribution of the final product to its market; and (5) the display or presentation of the material in one or more formats. Today, autonomous individuals (amateurs, artists) have access to tools for the recording, storage, and display of audiovisual information. However, very few of us have processing technology and only industrial corporations control national distribution. One consequence of this is cultural heteronomy ("other-law"), a hierarchical structure of authority and reality.

However, within a decade VLSI technology could provide autonomous individuals with the technical capability to engage in all five fields of moving-image practice. If the prodigious potential of this technology is realized, the computer, on line to broadband user-controlled networks, would become all the tools needed to generate, store, retrieve, process, edit, transmit, and display high resolution real time video. The computer would become the solid state camera, it would become the special effects processor, it would become (with the optical disc) the edit controller, it would become the "reality simulator" with real time high-resolution shaded 3-D graphics, it

would become the communications transmitter and display controller. In other words, if the technology at hand is exploited, the computer will become all the tools we need to practice the construction of social reality. The result would be cultural autonomy ("self- law"), a nonhierarchical structure of authority and reality.

The Moving-Image Arts: Electronic Versus Mechanical

At present all five fields of moving-image practice are based on a hybrid mechanical/electronic technology consisting of film, video, and the computer. It is generally expected that film will yield to electronic photography during the Eighties, and that by the end of the decade most audiovisual information will be produced, distributed, and displayed electronically.

In principle, electronic imaging is superior to mechanical film imaging in every respect. If this is not yet true in practice it's because electronic imaging is still analog: as in a conventional sound recording the signal consists of a continuously varying waveform. But electronic imaging will soon become digital, like the most advanced forms of sound recording. The video signal will be a stream of on/off pulses representing numbers in the binary code, virtually immune to interference and unintended distortion, and capable of being computer-processed in an unlimited number of ways. Special effects in video are now digital, but cameras and recorders are only at the prototype stage—television has not yet become totally computerized. It will be, though, by the end of the decade, and its superiority over film will be manifest.

In film, for example, the basic unit of creative construction is the fully-formed photographic image, whole and entire. In digital video we can in principle have access not only to the frame but to each of the 1000 scanlines that will constitute it by 1990, and not only that, but to each of the 1000 points (pixels) that will comprise each line. That's like being able to address individually each grain of emulsion in a film frame, assigning to it any one of, say, 250 grey-scale levels or color hues. The smaller the basic unit, the greater the variety of possible constructions—witness the brick house versus the prefab. With this in mind, let us now consider the probable impact of the computer revolution on the production, distribution, and display of audiovisual information.

Production

In approximately a decade the television camera will be a tubeless 100-percent solid-state handheld computer with image resolution equivalent to 35mm film, producing color pictures comparable with today's large format gravure prints. It will contain no internal optics and will focus automatically by sonar and Fourier Analysis; microprocessors for image deconvolution and enhancement will do away with the need for elaborate and expensive lenses. Zooming will be accomplished by computer operations on the signal rather than mechanical manipulation of the lens. Recording will be digital, on metal tape (later in semiconductor or bubble memory), and the entire camera/recorder unit, resembling a super-8 system, could be mass marketed for $1000 or less.

That's the computer as camera; but what about the computer as source of the image? Taking seriously the predictions about VLSI, and remembering that software trails hardware by about five years, we can safely assume that the personal computer of a decade hence will have at least the power of today's 32-bit mainframes if not our supercomputers. At the same time new memory technologies such as the optical disc and magnetic bubble memories will provide billions of words of storage at infinitesimal cost. Such a machine could generate high resolution 1000-line shaded 3-D graphics in real time. And with add-on cards it could function also as an image processor, performing all the post-production video effects today requiring $300,000 industrial tools or custom user-built devices like Dan Sandin's Digital Image Processor or Woody Vasulka's Digital Image Articulator. And it would control a read-write optical disc for video editing.

Of course the personal "geometry engine" with its flight-simulator graphics capability would be on line to broadband cable and switched optical-fibre networks, providing specialized distribution and access to "telegraphics" and "network reality simulation." At the amateur level, thousands of young warriors will live in labyrinthine networked adventure games; computer clubs will operate dedicated

cable-TV channels, showing their simulations and sharing their programs in video as the non-member cable audience looks on and learns. At the venture-capital level, commercial Image Utilities with pictorial data bases will offer real time interactive simulation: just punch up the appropriate cable channel, turn on your computer and take control of the animated output of Simulation Central. The visual data bases will consist of morphological, anatomical, and physiological algorithms for the synthesis of environments, figures, and behaviors specified and controlled by the subscriber, who could, of course, download the results in their own local memory for future metaconstructions.

Storage

The storage medium for audiovisual information after 1990 will be videotape and videodisc, digitally encoded. Thereafter will come a transition towards digital storage in computer memories with no moving parts. By the millennium a 90-minute movie could be stored in a matchbox-sized cube providing instantaneous access to any frame and variable playback speeds. It would be erasable and reprogrammable over videophone lines, through which it could also be made available to hundreds of users simultaneously, the playback for each one starting just a few milliseconds after the previous caller. This would make anyone potentially a mass distributor.

Processing

Digital post-production makes possible every conceivable manipulation of the image and sound (editing, synthesis, special effects) under computer program control. During the Eighties this will be accomplished with the optical videodisc controlled by a computer; in the Nineties the disc will be replaced by the computer memory. In the domain of computer reality-simulation, however, the concept of post-production is meaningless, since the reality pictured and the means of picturing it are identical.

Distribution

By the end of this decade most audiovisual information will be published on videodisc and cassette and distributed electronically by cable television and satellite, to cinemas as well as homes. In the Nineties, optical-fibre videophone networks, using laser light instead of electricity as the carrier medium, will begin to replace both cable television and direct- broadcast satellites, and by the end of the millennium this will be the dominant mode of domestic distribution. Movies, mail, education, work, and information will be handled by the same multipurpose network, whose channel capacity would be infinite thanks to the infinitude of light.

Display

The most dramatic technical development for the average person will be high-definition movie-quality television images, which should be widespread by the end of the decade. During the 1990s solid-state flat-panel displays will replace the cathode-ray tube, bringing even better picture quality and viewing flexibility; for example, television glasses, worn like spectacles, will provide 3-D stereo-vision. By the millennium, transparent solid-state displays resembling 35mm slides with motion will make possible the portable video projector, throwing a 2 by 6-foot 'scope image in the home or 70mm Panavision-type images in theatres.

Communication Versus Conversation

If these sweeping technological changes do in fact take place, a communications revolution would seem inevitable, bringing with it the rise of those autonomous reality-communities I mentioned earlier—communities defined not by geography but by consciousness, ideology, and desire. Paradoxically, the migration to autonomous reality-communities will not be achieved through communication. Communication (from the Latin "a shared space") is interaction in a common context ("to weave together") which makes communication possible and determines the meaning of all that's said: the control of context is the control of language is the control of reality. To create new realities, therefore, we must create new contexts, new domains of consensus. That can't be done through communication. You can't step out of the context that defines communication by communicating; it will lead

only to trivial permutations within the same consensus, repeatedly validating the same reality. Rather, we need a *creative conversation* (from the Latin "to turn around together") that might lead to new consensus and hence to new realities, but which is not itself a process of communication. "Do you mean this or this?" "No, I mean thus and such. . . . " During this nontrivial process we gradually approximate the possibility of communication, which will follow as a trivial necessary consequence once we've constructed a new consensus and woven together in a new context. Communication, as a domain of stabilized non-creative relations, can occur only after the creative (but non-communicative) conversation that makes it possible: communication is always non-creative and creativity is always non-communicative. Conversation, the prerequisite for all creativity, requires a two-way channel of interaction. That doesn't guarantee creativity, but without it there will be no conversation and hence no creativity at all. That's why the worst thing we can say about the mass media is that they can only communicate—at a time when creative conversations on a massive scale are essential for human dignity and survival.

Simulation and Desire

What's important to realize is that in our conversations we create the realities we will talk about by talking about them: we become an autonomous reality-community. To be conscious observers we need language (verbal or visual), and to have language we need each other: the individual observer, standing alone, is an impossibility; there is only the observer-community or reality community whose constituents can talk about things (like religion, art, science) because they create the things they talk about by talking about them.

As constituents of autonomous reality-communities we shall hold continuously before ourselves alternative models of possible realities. We shall learn to desire the realities we simulate by simulating the realities we desire, specifying, through our control of both medium and message, context and content, what's real and what's not, what's right and wrong, good and bad, what's related to what, and how. This is the profound significance of the Computer Revolution and the Arts, understood as simulations of realities. Simulation isn't fiction, it is the future of politics, reality and desire. The purpose of fiction is to mirror the world and amuse the observer; the purpose of simulation is to create a world and transform the observer. Behold: armies of amateurs gather even now, preparing for the Image Wars, conspiring to abolish once and for all the ancient dichotomies between art and life, destiny and desire.

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